TOWARDS THE VALIDATION OF A CONCEPTUAL DESIGN MANAGEMENT MODEL FOR REMOTE SITE PROJECTS

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In the last decade or so there has been an increasing number of remotely located and often environmentally sensitive sites becoming the focus for development work involving potential investors / entrepreneurs / stakeholders or government and non-government agencies. Projects on remote sites are frequently government funded, making the approval processes, and timelines for example, subject to political influence(s), which means that the projects are potentially more difficult to manage, at all levels of involvement. The aim of this paper is to demonstrate the research process undertaken so far, in order to validate a conceptual design management model for remote site projects. There were no previously documented empirical examples, nor theoretical models, for remote site design management. The research aimed to also demonstrate the potential portability of the model, in terms of offering a basis for a relevant management framework for built environment projects, international scientific drilling projects and international humanitarian aid projects. Multi case-study methodology was adopted as the primary method for developing and validating the design management model (Kestle and London 2002), as it involved empirical enquiry that afforded investigation of the remote site design management phenomenon within a real-life context. Two main case studies were conducted, one being an historical Antarctic Science Drilling Project, and the other a current UN Humanitarian Project in Sudan. Subsequently, the model has also been applied to a post-disaster reconstruction project in Aceh managed by the JRS. The findings to date support the conceptual design management model as being relevant for a non-profit and/or Humanitarian Aid projects in the post-disaster reconstruction context, and for a commercially based Antarctic Science project.

Keywords: case studies, design, management framework, reconstruction, remote sites.

INTRODUCTION

There has been an increasing number of remotely located and often environmentally sensitive sites becoming the focus for new or post-disaster development work involving potential investors, entrepreneurs, stakeholders or government and non-government agencies. Projects on remote sites are frequently government funded, making the approval processes and timelines subject to political influence(s). This

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means that the projects are potentially more difficult to manage, at all levels of involvement. Clients, stakeholders and construction organisations have been involved on major infrastructure projects such as canals, dams, power stations, bridges, oil and gas rig platforms, tourist resorts, defence and scientific bases for decades, and have taken a largely logistical approach to these environmentally sensitive remote sites (Kestle, London, Bodger and Storey 2002). The emerging environmental movement focused worldwide attention on the need for sustainable development of these sites, rather than the pragmatics of getting the job done, on time and on budget.

Research rendered no previously documented empirical examples or theoretical models for remote site management from published literature. Previous design and construction management and sustainability models did not address the unique aspects of projects on these particular sites. The research topic was therefore considered to be unique, given the lack of fundamental research in the area of design management, as described by Ballard and Koskela (1998), and specifically the design management of remote site projects located on environmentally sensitive and often hostile sites (Kestle and London 2003). There was an expectation that the research would result in the development and validation of a conceptual theoretical model in the field of remote site design management. The aim of this paper is to describe the research process undertaken so far in order to validate the conceptual design management model for remote sites developed by Kestle and London (2002). It is also intended to demonstrate the potential portability of the model, in terms of offering a basis for a relevant management framework for built environment projects, international scientific drilling projects and international humanitarian aid projects. The key terms associated with this research are identified, contextualised, and explained here, in order that the overall research topic, methodology and analysed data from the two main case studies can be more readily understood.

Remote Sites

Sites can be categorised and considered to be ‘remote’ in relation to their environmental sensitivity, the distance to the site from continuously available logistical support, the hostility of the environment in terms of the climate, difficulty of physical access to the sites, lack of available local materials and labour resources, and location in areas of hostile physical conditions. Remote sites are typically located within environmentally sensitive regions, primarily due to the region being previously undeveloped, or under-developed. Further, remoteness potentially falls into three different categories based on a continuum related to the physical distance of participants from the site:

1. where the project participants such as the design, construction and facility management personnel are not at, or adjacent to, the project site, instead being located in another city or town for the duration of the project,
2. where selected groups of the project participants are not initially located at or adjacent to the project site. For example, the design and construction management teams, or humanitarian aid consultants have their offices in other countries or regions, and may move to the project site’s region or install their agents within the region where the project site is located.
3. where the majority of the project participants are located adjacent to or actually at the project site, with the remainder being located remote from the project site (Kestle *et al.* 2002).

Remote sites pose unique challenges for the participants involved throughout the design, production and operational stages of a project. Increased global awareness of environmental issues and the emergent sustainability movement has created a focus for research and critical thinking in this area, however there is still a lack of fundamental research in the area of the development and management of remote, environmentally sensitive and frequently hostile sites (Kestle and London 2002).

Design Management

Design Management is regarded as an emerging field, and the discipline of design management is not focused on design per se; instead design management is a complex process that is fundamentally concerned with the integration of specialist knowledge, value generation, and the critical timing of key design and management decisions (Kestle and London 2002). The design and construction processes have become more complicated and fragmented over the last few years, and this has a series of differing, yet related impacts. One of the major impacts is the difficulty surrounding the development of a shared understanding of the objectives of a project amongst the various stakeholders (Tombesi 1997). Having a shared understanding that facilitates working toward the identification of what is valued in the project, impacts on how and when critical decisions are made on design and coordination issues. Poor integration of specialist user and producer stakeholder knowledge can result in an inappropriate synthesis of the needs analysis, leading to a lack of or a low level of value generation for the clients and stakeholders (Kestle and London 2002). Design managers have emerged as new and valued specialists on projects, who integrate and coordinate the design process and in particular, have the responsibility for the interface with other organisations involved on the project(s). Design managers are process coordinators, who ensure that the process deadlines, reviews and consequentials are met, keeping the focus on the tasks and objectives to achieve the value criteria set down and agreed for the project. The design and development process frequently involves a range of informed to ill-informed decision-makers, and this process and the resultant outcomes are driven by the initial and therefore critical decisions made at that time (London and Ostwald 1996). Add the dimension of remote site projects and the complexity, and the critical nature of the initial decision-making stages increases and diversifies even further.

Environmental Sustainability

One of the underlying concepts of ‘sustainability’ is that our relationship with the built and natural environments is permanent, and that there is an interdependent relationship between our activities and their effects on the planet. This is particularly relevant as many of the remote sites are pristine and therefore environmentally sensitive. The management of these environments has largely been associated with various legal instruments, such as international treaties and national acts, for example the Antarctic Treaty (1961) and the NZ Environmental Protection Act (1994). Any projects conducted in Antarctica have to go through rigorous and constraining Environmental Impact Assessment (EIA) procedures (Waterhouse 2001). At the initial stages of a project, consideration of the environmental sensitivity of remote sites may often be paramount to the overall pre-planning, design development, project development, and construction or operational stages.

RESEARCH METHODOLOGY

The aim of this particular research paper was to describe the research process undertaken so far, in order to validate the conceptual design management model for remote sites developed by Kestle and London (2002), and to also demonstrate the potential portability of the model, in terms of offering a basis for a relevant management framework for built environment projects, international scientific drilling projects and international humanitarian aid projects. The overall doctoral research question was "what are the key factors and drivers that constitute a plausible theoretical conceptual design management model for remote site projects?", and the main objectives were to develop and then validate a conceptual design management model for remote site projects. Firstly a typology for remote sites was created in association with the development of the Conceptual Design Management model, refer Figure 1, (Kestle and London 2002). The development involved selecting, reviewing and synthesising previously conducted and published relevant and related research, that included the published 'production principles', as defined by Huovila and Koskela (1998), and the 'sociological factors', as identified by Garnett (1999) and Huovila and Koskela (1998). These principles and factors were critiqued in terms of how they might be linked or associated with design management. In addition, lean design management was reviewed in reference to research by Koskela, Ballard and Tanhuanpaa (1997), and Seymour and Rooke (2001). The theoretical basis for the conceptual design management model was also based around theories of Just in Time (JIT), Total Quality Management (TQM) and Lean Production, as published by several authors associated with the International Group for Lean Construction (IGLC) research group (Kestle and London 2002).

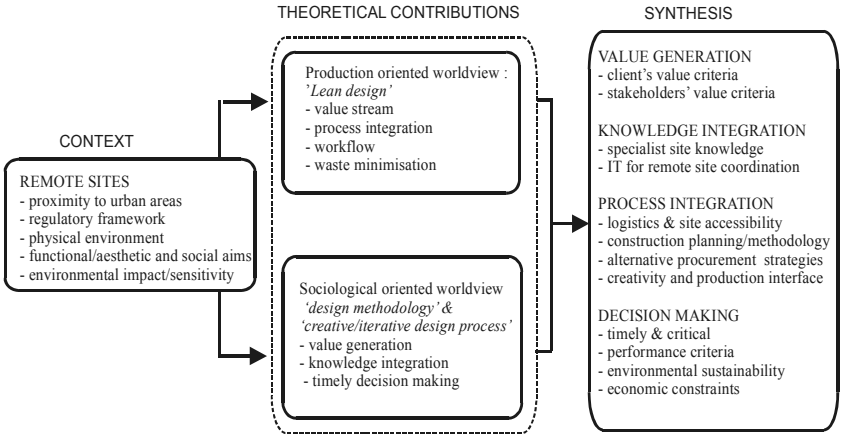

Figure 1: Conceptual Design Management Model for Remote Sites (Kestle and London, 2002)

Multi-case study methodology was adopted as the primary method for developing and validating the design management model (Kestle and London 2002), as it involved empirical enquiry that afforded investigation of the remote site design management phenomenon within a real-life context (Yin 1994). The developed model was then tested and reviewed in terms of two main case studies–one a retrospective review of a historical case study of an Antarctic Drilling Project, involving interviews with nine selected personnel who had worked on the project (2003/4), the other being a current UN Humanitarian Aid Project in West Darfur, Sudan (from 2004 onwards). The Sudanese Case study involved interviews with seventeen selected key personnel (including eight managers), in terms of their official roles. A third project used to test the model was a current Humanitarian Aid Tsunami Relief Programme, in Aceh, Indonesia (2004), managed by the Jesuit Refugee Services (JRS). Testing the model

on real-life projects aimed to not only validate the theoretical design management model for remote sites, but also demonstrate the potential portability of the model in terms of offering a basis for a relevant management framework for built environment projects, international scientific drilling projects and international humanitarian aid projects, in the post-disaster reconstruction context.

The Historical Antarctic Science Drilling Project at Cape Roberts, Antarctica

The selection of the case study was made on its ability to represent the phenomenon of remote site design management. The Cape Roberts Drilling Project (1995-2001), was considered to be a remote site project given a lack of continuously available logistical support; the site was difficult to access in terms of geographical location, being approximately eight hours flying time to New Zealand, and several hours hagglund and sledding time from Scott Base. The site experienced a seasonally hostile local climate, a complete lack of local materials and labour, and all resources had to be shipped or air freighted into Antarctica's Ross Sea Region, and sledded to the drilling site. The drilling project was an international collaborative effort involving seven countries–Italy, Germany, Australia, UK, United States, New Zealand and the Netherlands. Each country contributed to the scientific, management and/or operational aspects of the project. The Cape Roberts Project (CRP), comprised two quite distinct, yet parallel parts–one being science, the other logistics, both sharing the same overall objectives but with different timeframes and critical criteria to be met. The original management structure gave responsibility for the overall supervision of the project to the International Steering Committee (ISC). This management structure was problematic and was superseded by the CRP Operations Plan (1996), where there was an emphasis on an operational management team with recognition of the two distinct parts of the Project (science and logistics/operational) and recognition of the need for joint or bifurcated leadership. Those leaders each reported to the ISC and NZAP (Antarctica NZ), respectively (Cowie 2002). The complexity of the project and the associated management of this internationally collaborative project was evident to the steering committee and subsequent management personnel, and stemmed in part from the fact that there were seven countries involved, with their associated stakeholders and scientific expectations set against a non-negotiable timeline to achieve the desired scientific outputs. In addition, Environmental Impact Assessment (EIA) procedures are required for every activity in Antarctica whether conducted by the USA, New Zealand, German or Italian Antarctic Programmes. This places significant constraints on Antarctic projects, in terms of their inception, implementation and overall monitoring of each and every potential environmental impact (Kestle and Storey 2005).

A report on the Cape Roberts Drilling Project edited by Cowie (2002) assisted the selection of nine participants who represented a cross section of all the personnel involved in terms of their official roles on the project. A series of retrospective semi-structured interviews were conducted. The collected data were analysed within the context of the previously developed conceptual design management model for remote sites. The aim was to see how well the data matched, or added to the design management model in terms of the four key factors being: value generation; knowledge integration; process integration and timely decision making.

Findings in terms of testing the model

The semi-structured interviews sought to establish whether the 'key factors' of the design management model for remote sites were supported by the Cape Roberts

Drilling project personnel 'real-life' experiences on the project. Testing the collected data against the conceptual model under the four factors of value generation; knowledge integration; process integration and timely decision making, involved reviewing the responses specific to the Cape Roberts Antarctic Drilling Project. The results were extensive and generally consistent across all of the selected interviewees (Kestle and Storey 2005). The personnel interviewed unequivocally supported the four key factors of the design management model, as being valid for Antarctic remote sites generally, and accurately representing their experiences on the Cape Roberts Drilling project. The following key points were drawn from the collected data:

Value generation as perceived, or needing to be realised was: in the technical and scientific aspects, and specifically the scientific outcomes from examining the cores, and the contributions on the international stage, e.g. climate change, Kyoto protocol; in the 1.7km of core recovered at a very reasonable cost, i.e. considered great value for money by the 6 nations involved with NZ; in the need for low environmental impacts on the part of the project and the associated personnel.

Knowledge integration issues were seen to include: intellectual property issues preventing knowledge integration–seen as an inhibiting factor, e.g. problems that arose with 'patch-protection', where people did not want to share their valuable expertise with potential successors for fear of becoming dispensable; 'risk'–particularly in terms of the personnel selected for the project(s)–getting the wrong people may compromise the project outcomes; the situation where a pool of specialist remote site personnel is created within organisations to design and manage these particular project sites. The weakness, though, is where knowledge capital is not documented explicitly, and a successional framework of specialist personnel is not fully established within organisations.

Process integration as perceived, or needing to be realised, were seen to include: the consequences of no process integration was dissatisfied staff, burn-out, budget blow-outs, and at times an incomplete project; operational logistics and information management needing to occur in a timely and realistic manner; pre-planning and awareness of other team members needs, and consequences of all actions proposed.

Timely decision making issues were that: the key decision-makers have to be identified and recognised as having the appropriate authority to act and respond; fast, accurate and safe decisions were made in potentially dangerous situations–the result of having a very good responsive and responsible management structure; everything revolves around the environment as far as Antarctic project sites go–the weather controls everything–what, when, and if you can do anything, it is often called the Antarctic Factor; a lack of timely and critical decision making may result in the loss of a whole year, (or more) of core production, as the supply ship only goes in to Antarctica once a year (Kestle and Storey 2005). The personnel interviewed supported the four key factors of the design management model as being valid for Antarctic Remote Sites and as accurately representing their real-life experiences on the Cape Roberts Drilling Project in Antarctica.

The UN Sudanese Humanitarian Aid (UN SHA) Project in West Darfur.

The selection of the case study was also made on its ability to represent the phenomenon of remote site design and project management. The 'fit' of the project with the theoretical design management model, was addressed in terms of how well the four key factors of the conceptual design management model for remote site projects, and how the data collected from the selected participants, represented the

realities of designing and project managing projects such as the UN SHA Project in West Darfur. The overall aim of the UN SHA Project in West Darfur, was 'to make a difference' to the lives of the beneficiaries of the aid, the Internally Displaced Persons (IDPs). The complexity of the UN SHA Project in West Darfur and the associated management of this internationally collaborative project, was evident to the planning committee and subsequent management personnel, with all of their associated stakeholders and expectations. Aid representatives from UN HQs in Geneva and Khartoum, the USA, UK, European Union, NZ, and Australia contributed to the management and/or operational aspects of the project. This collaborative approach created a complex regime of project personnel, and tasks, that needed to be sensitively integrated, coordinated and managed. In addition there was a non-negotiable timeline to achieve the desired outcomes. The semi-structured interviews explored the project in its entirety with the seventeen selected key personnel, in terms of their official roles. Eight of the participants were managers from each of the agencies, and therefore knew the big picture objectives, the strategies being applied, and the desired outcomes.

Findings in terms of testing the model

The following key points were drawn from the collected data:

Value generation was singularly concerned with making a difference to the lives of the beneficiaries of the aid, the Internally Displaced Persons (IDPs). Provision of basic shelter and the necessaries of life, being at the core of the project's aims and was seen to include: the effectiveness, (and therefore the value) of the project, measured quantitatively by what was achieved e.g. how many built outputs; making a difference to the living conditions, in terms of emergency water and sanitary assessments in the field, acting on the recommendations; and timely implementation.

Knowledge integration as perceived, or needing to be realised was: that there were definite gaps in the knowledge integration process, no-one wanted to trespass on others' areas this was perceived as a possible hindrance to finding the best solution(s), and there were basically, informal and formal systems of knowledge integration; there was a problem with the planning and the reality–the specialised personnel who came in, could not do what they were best at, having to follow a particular plan, and therefore not necessarily seeing the desired or potential 'results on the ground'; there were gaps in specialist knowledge, in terms of the experiences of the people in the field versus those in the office; sometimes there was too much specialised knowledge on the project, and what was needed was a more holistic approach; a good knowledge of the IDPs' cultural and value systems was needed, before commencing the on-site work; the high turnover rate of people in these roles, meant that key information was not fully recorded if at all.

Process integration as perceived, or needing to be realised, was: trying set up the best processes and systems in response to the IDPs' immediate and longer term needs; trying to achieve co-ordination at the camp level, and engage in meaningful and useful relationship-building with the International, and IDP Communities, whilst not always knowing the other agencies' plans; about co-ordination of the various groups, on this project, and that little could have been achieved without the Sudanese people and their expertise, as they had valuable connections and networks within the community; making sure that assessments were correct, and then preparing a plan that was thorough and addressed the challenges within the timeframe, and the budget.

Timely decision making as perceived, or needing to be realised, on the West Darfur Humanitarian Aid Project, in Sudan was: that decision-making on this project was reactive and prescriptive–the detailed, and bigger picture decisions were fed from the 'Field' back to central, where the tailoring occurred, and the decisions, and plans, were fine tuned; that at the organisational level, the decision-making needed to be de-centralised–there were instances of considerable time and opportunities lost due to bureaucracy, set against instances of high levels of co-ordination between West Darfur, Khartoum and the agency's head office where the staff were given almost total autonomy in the 'Field', and dedicated organisational finance project personnel.

The results from the analysed participants' data were generally consistent across all of the selected interviewees, though some of the respondents on the UN SHA project appeared to have more autonomy than others, in terms of playing a real part in the decision-making processes. The personnel interviewed supported the four key factors of the design management model as being valid for Humanitarian Aid project sites generally, and as accurately representing their real-life experiences, or those that were needed, on Humanitarian Aid projects, such as West Darfur. The results from these two main case-studies provided significant support to the validation of the conceptual design management model for remote sites, and to the associated typology (Kestle, Potangaroa and Storey 2006).

The Tsunami Relief Programme in Aceh, Indonesia

A subsequent study of a project managed by the Jesuit Refugee Services (JRS) extended the application of the conceptual design management model by Kestle and London (2002) to identify where value was added (both perceived and actual) by the JRS as part of its Tsunami Relief Programme(TRP) in Aceh, Indonesia in 2004 (Potangaroa and Kestle 2008). The JRS programme had been running from 2001 with a focus on relief, emergency support and accompaniment of refugees and IDPs. As part of an evaluation of their two year tsunami programme in Aceh, JRS believed that they had 'their own particular way of doing things' and this was considered by those in the field as being the main way in which JRS 'added value to humanitarian programmes'. The field team believed that their added value was linked to the perceived flat organisational structure and its bottom-up management structure, which allowed rapid responses to changing circumstances in the field. JRS organisational structure comprised only three levels from their national office in Yogyakarta to the field staff. Semi-structured interviews were conducted with seven members of the JRS management team and their responses to each of the four key factors of the design management model for remote sites were summarised and tabulated into a contextual spreadsheet, which afforded comparisons and allowed patterns to become more evident (Potangaroa and Kestle 2008).

Findings in terms of applying and testing the model

All of the seven managers interviewed were concerned about value generation and the need for flexibility in their management approach, whilst providing speedy responses to beneficiaries, as this was the 'main added value' that JRS believed they provided.

The sense for the field was that specialist knowledge and process integration was and is required to ensure best design solutions and integrated processes, from the early stages of the project, followed by regular monitoring for the best end results. However, they believed that that did not in fact happen on the TRP project. The team instead relied heavily on the reporting of transactional narratives with beneficiaries for its knowledge integration. Managers acknowledged the need for better systems, but

they admitted to implementation difficulties and that there were issues in attracting any staff, let alone specialist staff to their programmes. Process integration was essentially 'rule-based' with a 'go and see' approach rather than any pre-planning or strategic operational planning being evident in their responses to the interview questions. Timely decision-making was seen as centralised or decentralised dependent on the participant's 'distance from the field'. Those based in National office saw the process as decentralised, and those based in the field saw the process as centralised, and strictly controlled by processes and rules. In applying the model, was the perceived sense that 'flexibility and speed of response to beneficiaries was the main value-added service that JRS provided', confirmed. JRS management approach was not in fact recognised as value-adding on the TRP project, in part because of the informal levels of knowledge integration, and the reliance on feedback and field reports from the beneficiaries, which also identified that a more flexible and responsive approach would in fact add value in any future programmes (Potangaroa and Kestle 2008). The interesting and somewhat unexpected outcome was the usefulness of Kestle and London's (2002) conceptual design management model in analysing JRS Tsunami Relief Project from a value-adding perspective, suggesting that the model was more robust and portable than perhaps originally thought, when it was initially developed and subsequently tested on the Antarctic Science and Sudanese Humanitarian Aid projects.

CONCLUDING REMARKS

The aim of this research paper was to describe the research process undertaken so far, in order to validate the conceptual design management model for remote sites, and to also demonstrate the potential portability of the model in terms of offering a basis for a relevant management framework for not only built environment projects, but also international scientific drilling projects and international humanitarian aid projects. These aims have been demonstrated to date on the two main case studies, and a subsequent post-disaster construction tsunami relief (JRS) project in Aceh. The case studies represent diversely different disciplines and remote site locations. Each has confirmed that the conceptual design management model for remote sites is effective in modelling and understanding the issues related to the realities of managing those projects. The model also provided a framework to compare what actually happened 'in the field / on site' versus that which was contained within the management plan(s), and was also effective when analyzing the JRS project, a third case-study, where the aim was to establish the value added to humanitarian aid programmes.

Future Research

A UN discussion document which formed the basis for the Cluster Approach in managing humanitarian aid operations, will be compared with the overall case study research findings from the UN SHA project in West Darfur, in terms of the multi-disciplinary conceptual design management model for remote sites, in a later paper. In addition, a further research stage involving the development of a project planning framework specifically for Humanitarian Aid (HA) will be conducted.

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